

# THE INFLUENCE OF KNEADING TIME ON BREAD DOUGH QUALITY

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**Abstract:** *Bread is the oldest and more important product made from flour. The information's regarding bread making is from the period of history when man first started to develop civilization. The quality of bread can be influence by a number of factors, like flour quality, production process, mixing and kneading time. In this paperwork was determinate the influence of kneading time on the sensorial qualities and on the other basic properties. Kneading times were varied from 2 to 20 minutes. The bread was obtained from two types of flour: wheat flour and rye flour.*

**Key words:** *kneading time, rye flour, sensorial qualities, kneading time.*

## 1. Introduction

Bread is a staple food prepared by baking dough of flour and water. It is popular around the world and is one of the world's oldest foods. One of the most important operations in the manufacturing process of bread is dough kneading.[4]

The main purpose of the kneading operations is to obtain a homogeneous mixture of the raw and auxiliary materials and at the same time obtain dough with viscous-elastic structure and properties. In addition, while kneading, in dough it is included a quantity of air, which is very important for rheological properties of the dough, and for the quality of the final product. During kneading frictional heat causes the rise of the dough temperature. To control the desired dough temperature the water temperature has to be adjusted.

When the ingredients are thoroughly mixed and the gluten network is sufficiently elastic and extensible the dough is ready. When a piece of dough is stretched up to a thin film without breaking, it shows that the dough is ready for further operations. [1]

The order in which the ingredients are added is very important. It must ensure a good hydration of the dough's components, mainly of the protein in flour.

The formation of the dough with its specific structure and rheological properties occurs because of several processes such as physical, colloidal, biochemical, and the main role are being held by the physical and colloidal processes. [6]

The formation of dough and its rheological properties are influenced by some factors that are shown in Figure 1.

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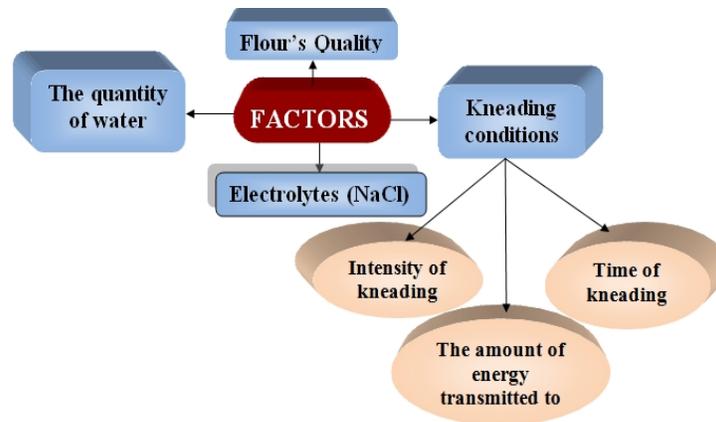


Fig.1. *Factors influencing the formation of dough*

The kneading conditions influence profound the properties of the dough and they can lead to an optimal growth, an incomplete development or to extra-kneaded dough.

The quality of flour influences the quality of the dough and also the bread quality. At the dough obtained from flour of poor quality, the protein pellicles are breaking easily, even before distributing them evenly in the dough. At the dough made from flour of good quality, the hydrated proteins are elastic and, when the dough is extra kneaded, protein pellicles have relatively only few breaks. This stability is one of the most important and desired characteristics of flours.[3]

Increasing water content in the dough is accompanied by the reduction of the elastic properties and viscosity of dough. A humidity of 44...50% does not modify the dough's structure, but exercises a plasticity effect.

Moisture content below 44% does not allow optimum gluten formation.

Electrolytes, especially salt (NaCl) addition changes the nature and intensity of hydrophobic interactions between the gluten proteins. Once with the addition of salt, the ionic force increases and this

reduces the capacity of proteins to retain water. The end of kneading is appreciated through sensorial analyses. Well-kneaded dough should be homogeneous, tight, consistent, elastic and easy to come down from the mixer's arm and form the walls of the kneading container. When is tested manually, stretched between thumb and forefinger, the dough is must become a thin strip, transparent and flexible without breaking. [8]

Insufficiently kneaded dough is homogeneous, but sticky and viscous. Excessive kneaded dough is very extensible, without tenacity and is breaking at the manual test. [10]

## 2. Materials and method

For making the bread were used the following raw and auxiliary materials:

- Yeast
- Salt
- Water
- Wheat and rye flour

There were used tree types of flour, rye flour and two types of wheat flour: type "650" and type "000". The characteristics of all three types of flour are shown the in Table 1.

*Characteristics of flour - raw material*

Table 1

CHARACTERISTICS	WHITE FLOUR type „650”	WHITE FLOUR type „000”	RYE FLOUR
Humidity [%]	14	14.5	14.5
Wheat gluten[%]	25.6	26	Doesn't have gluten
Acidity	3	2.2	4.5

- The bread was made with the follow raw and auxiliary materials characteristics:
- Wheat flour type “650”- 50%
  - Wheat flour type “000”- 20%
  - Rye flour- 30%
  - Yeast - 3%
  - Salt- 1.5%
  - Water- 58%

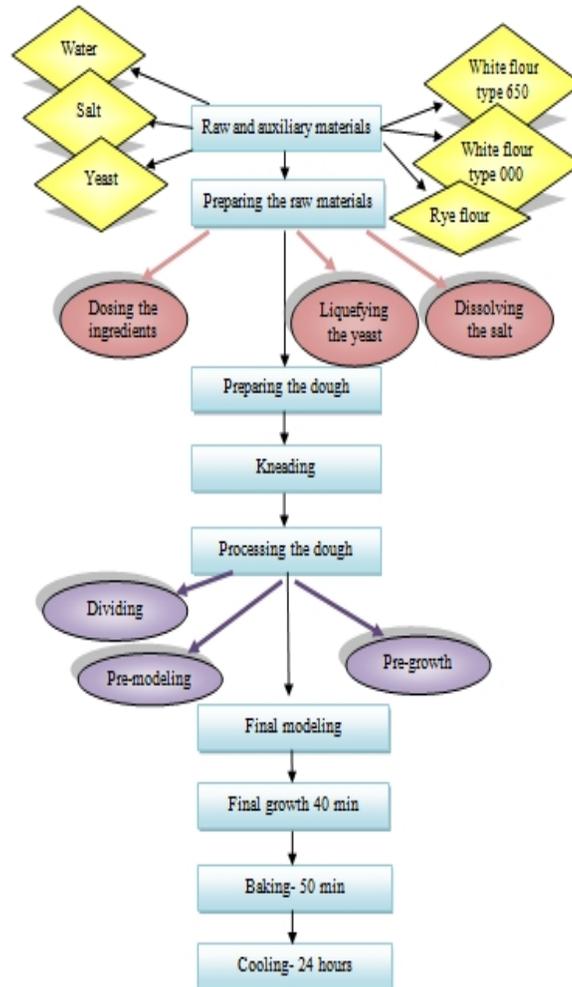


Fig. 2. *The operational program for obtaining the bread*

For the experiment, there were baked four loaves of bread, each following the same recipe. Same operator, in same laboratory and conditions, did the kneading manually. Fermentation and baking times are identical for all of the samples. The first sample was kneaded for two minutes after all the ingredients were incorporated.

The second sample was kneaded for 4 minutes, the third one eight minutes and the fourth one 20 minutes. After being baked, the four loaves obtained were left to cool slowly for 24 hours and then were made the necessary analyses regarding the bread quality. The operational program for obtaining the bread is shown in Figure 2.

### 3. Results and discussions

After analyzing the results it was found that the kneading time of dough affects physical and chemical properties and the qualities of the finished product, bread. From sensorial analyze point of view, the four samples don't have any significant differences. Using the same recipe, there are no differences in taste or smell; the 4 loaves of bread have the same taste and smell. The color of the peel is white creamy, slightly browned, with a firm consistency. Baking time was identical for all four samples, about 50 minutes.

*Determination of porosity*

Table 2

Kneading time	Cylinder weight with pores [g]	Cylinder weight without pores [g]	Porosity [%]	Standard Porosity [%]
2 min	54,6	59	52,68	Min. 65
4 min	50,0	54,2	56,53	
8 min	42,0	46	63,10	
20 min	52,3	56,8	54,44	

Comparing the results and given the fact that the bread is a semi, the porosity of the sample baked for two minutes is the smallest. On the other hand, the porosity of 8 minutes sample has the highest porosity.

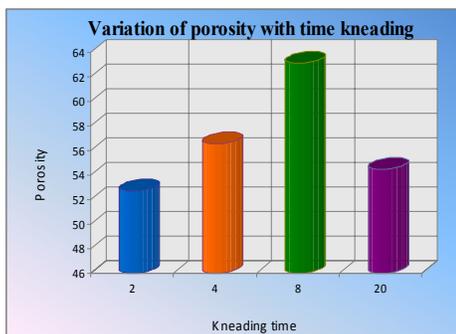


Fig. 3. *Variation of porosity*

Thus, one can say that the kneading time has a great influence on this feature. It is

observed that, with increasing time of kneading the dough becomes more elastic, its properties tending to be identical to the properties of the dough which was kneaded for two minutes. This is confirmed by its porosity that reaches 54.44%. Compared with white bread, rye bread is denser, less porous due to the lack of gluten.

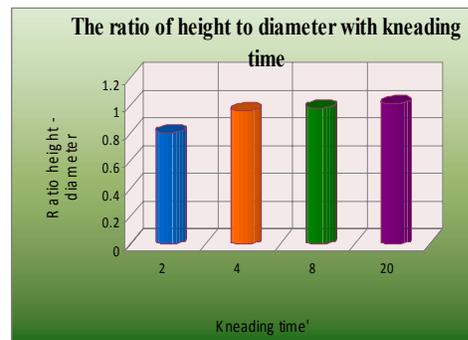


Fig. 4. *Ratio of height with diameter*

The ratio of height with diameter shows that the prolongation of kneading time leads to increasing the bread's volume. From these results, it can be observed a significant increase from 0.80 mm at the sample kneaded for 2 minutes up to 1.01 mm for the bread mixed for 20 minutes. Because it was obtained the highest test result for the bread mixed for 20 minutes, sample shows that with the prolongation of kneading time is increasing the height and the diameter of the bread.

*Acidity* Table 4

Kneading time [min]	Acidity	Standard Acidity
2	1,8	Max.5
4	1,6	
8	1,6	
20	1,6	

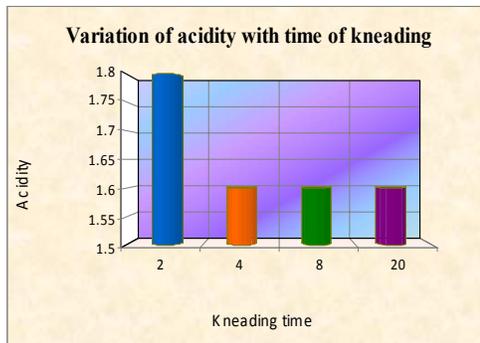


Fig. 5. *Variation of acidity*

The acidity determination reveals a constant value for samples 2, 3, 4. For the bread mixed two minutes, the acidity is higher, but falls within acceptable limits, the maximum acidity being 5 °T.

Moisture values for all four samples fall within the standard 42%. The highest value was found for bread mixed 2 minutes, 38%, for samples of 4 and 20 minutes was obtained a constant value of 36%.

*Humidity* Table 5

Kneading time [min]	Humidity %	Standard Humidity %
2	38	Max.42
4	36	
8	34	
20	36	

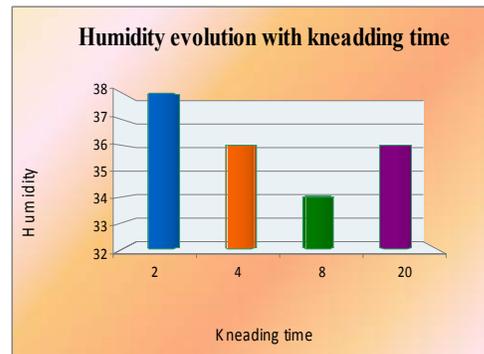


Fig. 6. *Humidity evolution*

The bread kneaded 8 minutes has the lowest humidity 34%, taking into account that we used the same amount of bread core.

## Conclusions

1. Bread is a staple food prepared by cooking dough of flour and water and often additional ingredients. Dough is usually baked, but in some cuisines breads are steamed, fried, or baked on a frying pan (e.g., tortillas).
2. All the operations that are done to the dough are very important and influence a lot its growth and so the final product.
3. The preparation method influences greatly the quality characteristics of the finished product, so we see that by diminishing the kneading time, the bread obtained has specific sensorial characteristics but lower quality index.

4. Increasing water content in the dough is accompanied by the reduction of the elastic properties and viscosity of dough.
5. Well-kneaded dough should be homogeneous, tight, consistent, elastic and easy to come down from the mixer's arm and form the walls of the kneading container.
6. The best results were obtained for the bread that was mixed 8 minutes. Comparing white bread and rye bread, we see major differences in terms of quality characteristics.
7. The rye bread is a dense one, with low porosity, with a smaller volume compared with white bread, with a slightly sour taste, with a hard crust, but with important nutritional intake.
8. The caloric intake of rye bread is lower than ordinary bread: 210 calories/100 g, compared with 280 calories/100 g in white bread. The rye bread, unlike white bread is richer in B vitamins, minerals and fiber that are important for the body.

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